





## USGS NSF GRIP Opportunity

● <b>USGS Center:</b>	Earthquake Science Center
● <b>Project Title:</b>	Experimental studies of induced earthquakes
● <b>Project Hypothesis or Objectives:</b>	<p>Extraction and especially reinjection of fluids in the earth's crust, typically associated with waste water disposal, enhanced geothermal reservoir stimulation, and geothermal energy, gas, oil and oil shale production, can produce induced earthquakes. This seismicity is the result of changes in pore pressure or stress state in the subsurface that are sufficient to reactivate preexisting faults or produce failure of the rock itself in the region surrounding the well. Whether or not seismicity is induced depends on the ambient stress state of the rock, the specific time-dependent relations among the frictional, fracture, and hydraulic properties of the local formations and basement, the rate and amount of fluid injection or extraction. In the case of injection, the temperature of the injected fluid relative to the ambient conditions at depth can also induce seismicity. Because temperature, stress, stressing rate, and pore fluid pressure are controlled and measured in the laboratory setting, and because hydraulic properties, wavespeed, slip velocity and acceleration can also be directly measured, experimental rock mechanics is ideally suited for targeted research into induced earthquakes. The objective of this graduate research internship is to conduct new experimental research to understand more precisely how seismic faulting is induced or triggered by fluid injection/extraction, and how the source properties and ground motion of induced earthquakes and seismicity may differ from background earthquakes and earthquake populations.</p>
● <b>Duration:</b>	up to 12 months
● <b>Internship Location:</b>	Menlo Park, California
● <b>Area of Discipline:</b>	geophysics, seismology, experimental rock mechanics
● <b>Expected Outcome:</b>	Experimental research in induced faulting is needed and has been targeted as a priority by the earthquake program at USGS. In addition to contributing to improved understanding of the physics of

induced seismicity, for USGS research results from this project will initiate basic research into the origins of induced earthquakes. For the intern the project will lead to valuable insights into the physics of faulting, experience in laboratory experimentation, access to the broad resources and expertise of the advisors and associated scientists at the ESC, and unique scientific contributions to their dissertation research and resume.

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|  <b>Special skills/training Required:</b> | Prior experience in laboratory rock mechanics is desirable but not required. However, mechanical aptitude and a strong interest in conducted laboratory experiments are required.  |
|  <b>Duties/Responsibilities:</b>          | With the research advisors' assistance the intern will develop an experimental research program to investigate the occurrence of induced and triggered earthquakes or their resulting properties. Intern's responsibilities will include conducting the experiments, analyzing the results, and reporting the findings at professional meetings and in one or more peer-reviewed journal publications. |
|  <b>Point of Contact or Mentor:</b>       | David Lockner/Nick Beeler/Ole Kaven  |
|  <b>Point of Contact e-mail:</b>          | <a href="mailto:dlockner@usgs.gov">dlockner@usgs.gov</a> / <a href="mailto:nbeeler@usgs.gov">nbeeler@usgs.gov</a> / <a href="mailto:okaven@usgs.gov">okaven@usgs.gov</a>   |